PATENT ABSTRACTS OF JAPAN

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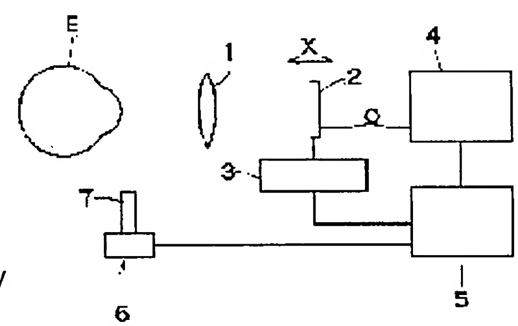
(54) SELF-CONSCIOUS REFRACTION MEASURING DEVICE

(57)Abstract:

PURPOSE: To dispense with a special optical member and measure the ophthalmic refraction by the operation of a testee itself by providing a target observing system for varying the diopter of the target generating at least three-directional stripe patterns and a responding means for the response by the testee, and determining the refraction value from the diopter of the target at response.



CONSTITUTION: At measurement, any one of a plurality of stripe patterns is displayed on a target 2 by a target generating means 4, and a testee observes the target 2. The target 2 is driven in X-direction in this state by a driving means 3 to change the diopter, and at the point of time when the testee can visually confirm it, he pushes down a control lever 7 in the direction of the same stripe pattern on a responding means 6 to respond it. According to the response signal, another stripe pattern differed in the direction or pitch of the stripe pattern is shown, the diopter regulation is similarly performed, and the following refraction value is calculated from the diopter at the point of time when the testee responded. The pitch of the stripe pattern is gradually set fine to rough, and the visual acuity is measured from the pitch when the testee visually confirmed it.

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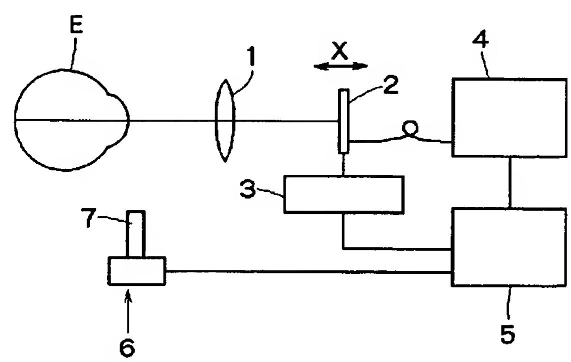
(54)【発明の名称】　自覚屈折測定装置

(57)【要約】
【目的】　簡単な操作で被検者自身が自覚屈折力を測定する。
【構成】　視標発生手段４から３方向の縞パターンを視標２に発生させ、被検眼Ｅはレンズ１を通して視標２を観察する。視標２は駆動手段３により光軸上の矢印Ｘ方向に駆動されてその視度を変化させ、被検眼Ｅは視標２を視認した時点で応答手段６の操作桿７を縞パターンの方向に倒して応答を行う。このときの視度から屈折力を求める。



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【特許請求の範囲】

【請求項１】　少なくとも３方向の縞パターンを発生する視標と、該視標の視度を可変する視標観察系と、被検者が応答する応答手段とを有し、応答時の視標の視度から屈折値を求めることを特徴とする自覚屈折測定装置。

【請求項２】　前記縞パターンは液晶により表示するようにした請求項１に記載の自覚屈折測定装置。

【請求項３】　前記視標は中央部に前記縞パターンを表示し、周辺部は拡散反射面とした請求項２に記載の自覚屈折測定装置。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、眼科病院や眼鏡店で眼屈折力の測定に使用される自覚屈折測定装置に関するものである。

【０００２】

【従来の技術】従来から眼屈折力を自覚的に測定するには、ホロプタのように屈折力の異なるレンズを用いて被検眼に視標を呈示するユニットを設け、視力表と組み合わせて屈折力を測定する方式や、眼鏡の仮枠を被検者に装着し、屈折力の異なる交換用レンズを順次に仮枠に挿脱して屈折力を測定する方式が行われており、一部には筐体にターレット式自覚屈折計を組み込み、被検者が観察窓を覗き検者が操作を行う自覚屈折力測定装置も使用されている。

【０００３】

【発明が解決しようとする課題】しかしながら上述の従来例の場合は、何れの方式も被検者の判断に基づいて屈折力の測定を行うものであり、判断のできる検者を必要とする。更に、装置には円柱レンズ等の特殊な光学部材を用いなければならない。

【０００４】本発明の目的は、上述の問題点を解消し、特殊な光学部材を必要とせず、被検者自身の操作によって測定が可能な自覚屈折測定装置を提供することにある。

【０００５】

【課題を解決するための手段】上述の目的を達成するために本発明に係る自覚屈折測定装置は、少なくとも３方向の縞パターンを発生する視標と、該視標の視度を可変する視標観察系と、被検者が応答する応答手段とを有し、応答時の視標の視度から屈折値を求めることを特徴とする。

【０００６】

【作用】上述の構成を有する自覚屈折測定装置は、少なくとも３方向に方向を変えられる縞パターン視標を視度を変化させながら呈示し、被検者はこの視標を視認した時点で応答を行い、このときの視度に基づいて屈折値を測定する。

【０００７】

【実施例】本発明を図示の実施例に基づいて詳細に説明

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する。図１は第１の実施例の構成図を示し、被検眼Ｅの前方の光路上に、レンズ１、画像用液晶表示板から成る視標２が配置されている。被検眼Ｅはレンズ１の前側焦点位置にあり、視標２を動かしてもその視角は変わることがないようにされている。視標２はその視度を変化させるために、光軸上を矢印Ｘ方向に駆動させる駆動手段３に接続され、更に図２(a)、(b)、(c) に示すような少なくとも３方向の縞パターンPa、Pb、Pcを発生する視標発生手段４が備えられている。なお、視標２にこのような液晶表示手段４を用いずに、１方向の縞パターンを描いた画面を機械的に３方向に回転させるようにしてもよい。

【０００８】駆動手段３と視標発生手段４には信号処理制御手段５の出力が接続されており、信号処理制御手段５には被検者が視標２を視認した時に応答を行う応答手段６の出力が接続されている。また、この応答手段６には操作桿７が設けられており、図３のように３方向の縞パターンが操作桿７の回りに描かれ、被検者が視認した縞パターンPa、Pb、Pcの何れかの方向を応答できるようになっている。

【０００９】測定時には、視標２に視標発生手段４により図２に示す縞パターンPa、Pb、Pcの何れかが表示され、被検者は視標２を観察する。駆動手段３によって視標２をＸ方向に駆動してその視度を変化させ、視認された時点で被検者は応答手段６上の同一縞パターンの方向に操作桿７を倒して応答する。なお、応答手段６は縞パターンの方向を入力するものではなく、単に視認時点で釦を押して応答するだけのものでもよい。

【００１０】信号処理制御手段５は応答手段６からの信号を検出すると、縞パターンの方向やピッチが異なる別の縞パターンを呈示して同様に視度調節を行い、被検者が応答した時点の視度から次の屈折値を算出する。

【００１１】遠点屈折値を求める場合には視標２を遠方から近方に移動し、近点屈折値を求める場合には逆に近方から遠方に移動する。即ち、視標２をプラスディオプタ方向、例えば＋２０ディオプタ方向の遠方側から近方側に移動すると、その縞パターンに垂直な経線の屈折値の位置に視標２が至ったときに、被検者がその視標２を視認できるので、このときに応答を行う。

【００１２】縞パターンのピッチは細かい方から徐々に粗くしてゆき、被検者が視認したときのピッチから視力を測定するが、縞パターンのピッチが細かい程精度の良い測定ができるので、初めは視力０．５位に相当する比較的粗いピッチを用いて概略の屈折値を求め、徐々に細かいピッチの縞パターンを用いて測定精度を上げることが好ましい。このとき、視度を変化させる速さは粗いピッチの縞パターンでは素早く変化させ、細かいピッチの縞パターンでは徐々に変化させる。このように、縞パターンをどのような順序で呈示するかの制御方式は、予めプログラムしておくことが望ましい。

【0013】乱視眼では、屈折値は縞パターンの経線方向によって異なるので、少なくとも3方向の縞パターンを呈示し、3経線方向の屈折値を求める。それらの値から信号処理制御手段5は乱視を含む屈折値を演算する。このとき、経線方向の屈折値の変化が正弦波的と考えると、球面屈折値、乱視量、乱視角等の視機能を求めることができる。

【0014】図4は第2の実施例を示し、両眼視で測定する自覚屈折測定装置を上方から見た構成図を示している。左右眼EL、ERの前面には、それぞれ眼幅方向の矢印Y方向に駆動することのできるユニット10L、10Rが設けられている。これらのユニット10L、10R内には、被検眼EL、ER側から対物レンズ11L、11R、ダイクロイックミラー12L、12R、ミラー13L、13Rが配列されている。ダイクロイックミラー12L、12Rのそれぞれの反射方向には、ハーフミラー14L、14R、瞳孔間距離測定用の二次元アレイセンサ15L、15Rがそれぞれ配置され、ハーフミラー14L、14Rの入射方向には、レンズ16L、16R、赤外LED等の光源17L、17Rがそれぞれ配置されている。

【0015】ミラー13Lの反射方向にはミラー18が設けられ、ミラー18とミラー13Rの反射方向には、それぞれ偏光板19L、19R、液晶板20L、20Rが配置されている。液晶板20L、20Rは電圧を印加したときに旋光性が消え、切ったときに45゜の旋光性を生じ片眼ずつ縞パターンを呈示することができる。液晶板20L、20Rの背後の光路が交差する位置にハーフミラー21が配置され、更に偏光板19L、液晶板20Lと同軸に、矢印X方向に駆動するレンズ22、画像用の90度TN液晶板から成る視標23、偏光板24が配列されている。

【0016】視標23は図5に示すように、偏光性を有し少なくとも3方向の縞パターンを表示する中央視標Cと、遠景が描写された拡散反射面から成る周辺視野Dとから構成されている。視標23の後方にはその中央視標Cを背後から照明する光源25が設けられ、視標23の斜め前方にはその周辺視野Dを斜め前方から照明する光源26が設けられている。なお、本実施例においては図示は省略しているが、第1の実施例と同様の視標発生手段及び応答手段が設けられている。

【0017】光源17Lからの光束は、レンズ16Lを通りハーフミラー14L、ダイクロイックミラー12Lで反射し、対物レンズ11Lの後側焦点に一旦結像した後に、平行光束が対物レンズ11Lから被検者の左眼ELに投射される。左眼ELの角膜に結像した光源像PLは、同じ光路を戻りハーフミラー14Lを透過して、二次元アレイセンサ15Lに図6に示すように前眼像EL' と共に再結像される。

【0018】同様に、右眼ERに対しても光源17Rの像PRが二次元アレイセンサ15Rに再結像されるので、これらの光源像PL、PRの位置をコンピュータにより演算して瞳孔間距離を求め、ユニット10L、10Rを矢印Y方向に駆動して瞳孔間距離を合わせる。このとき、被検者の顔が装置に接近したことを検知して、瞳孔間距離の調節を開始するようにするとよい。

【0019】第1の実施例と同様に、視標23の中央視標Cに少なくとも3方向の縞パターンが呈示され、被検者は両眼視の状態で片眼ずつ順次に測定を行う。視標23からの光束は、ハーフミラー21により左右の光路に分割されて、それぞれ左右眼EL、ERに到達する。そして、レンズ22を光軸上の矢印X方向に駆動して、視度を変化させることによって屈折値を測定する。

【0020】なお、視標23は第1の実施例の視標2とは異なり、片面にのみ偏光板24が設けられているので、この偏光板24と垂直の透過偏光方向を有する偏光板19L又は19Rとを通すことによって、被検者は縞パターンを観察することが可能となる。つまり、液晶板20L又は20Rに電圧を印加すると、液晶の分子は面垂直になっており旋光性を示さないので、被検者は常時縞パターンを観察することが可能となり、これによって左右眼EL、ERの選択を行って順次に縞パターンを呈示することができる。

【0021】また、光源26により照明された周辺視野Dは拡散反射面であり偏光性がないので、液晶板20L又は20Rの作動には関係なく常に両眼視ができる状態にあり、この周辺視野Dを視認しながら融像するようにすれば、輻輳が生じないので調節を起すことはない。

【0022】図7は第3の実施例を示し、ホロプタを用いた自覚屈折測定装置である。ホロプタヘッド30には、レンズターレットとその駆動モータが含まれ、被検者が覗く開口30L、30Rが設けられている。ホロプタヘッド30は視標パターン発生回路やシーケンスプログラムを含む制御手段31に接続され、制御手段31の信号は、発生した縞パターンを表示するテレビモニタ32と、被検者が縞パターンを視認して応答を行う応答手段33に接続されている。

【0023】制御手段31の視標パターン発生回路により、テレビモニタ32上に少なくとも3方向の縞パターンが別個に発生され、被検者は5m程度離れた位置にあるホロプタヘッド30の開口30L、30Rを通して、テレビモニタ32上の縞パターンを観察し、応答手段33により応答を行う。この場合に、制御手段31の信号により視度を遠視側から徐々に近視側に変化させ、被検者が視認した時点で応答を行い、このときの視度から屈折値を求める。また、縞パターンを3方向について順次に測定を行うことにより、乱視度も測定することができる。

【0024】

【発明の効果】以上説明したように本発明に係る自覚屈

折測定装置においては、少なくとも3方向の縞パターンを視標に発生させ、被検者の応答時の視度から屈折値を求めることにより、測定に際し特に検者を要することなく、被検者自身が簡素な装置を用いて簡単な操作により自覚屈折測定を実施することができる。

【図面の簡単な説明】

【図1】第1の実施例の構成図である。

【図2】視標の縞パターンの説明図である。

【図3】応答手段の平面図である。

【図4】第2の実施例の構成図である。

【図5】中央視標と周辺視野の正面図である。

【図6】二次元アレイセンサ上に結像した前眼像と光源像の説明図である。 ＊

＊【図7】第3の実施例の構成図である。

【符号の説明】

２、２３　視標

４　視標発生手段

５、３１　制御手段

６、３３　応答手段

１５Ｌ、１５Ｒ　二次元アレイセンサ

１６Ｌ、１６Ｒ、２５、２６　光源

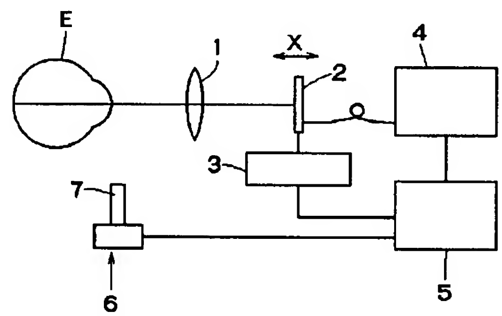
１９Ｌ、１９Ｒ、２４　偏光板

２０Ｌ、２０Ｒ　液晶板

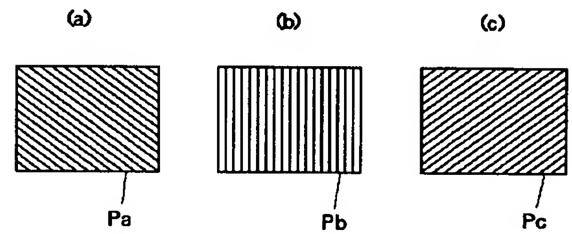
３０　ホロプタヘッド

３２　テレビモニタ

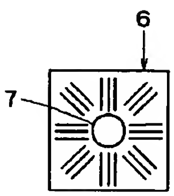
【図1】



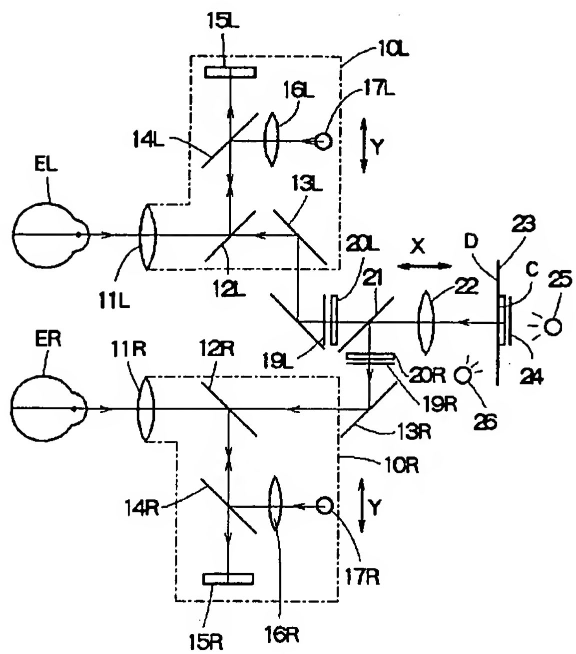
【図2】



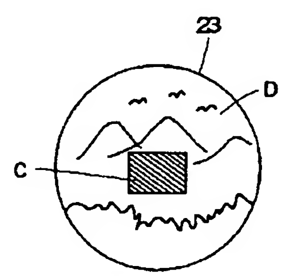
【図3】



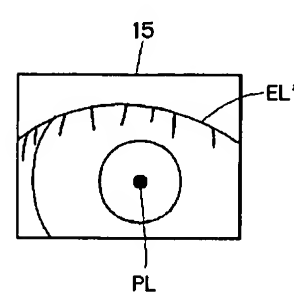
【図4】



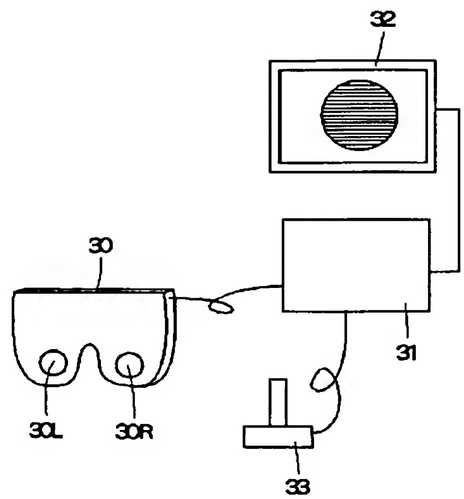
【図5】



【図6】



【図7】



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CLAIMS

[Claim(s)]

[Claim 1] In ophthalmology equipment with required having an inspection means examined the eyes and aligning optometry-ed in a position relation to this inspection means The illumination-light study system which illuminates the anterior eye segment from which the optical distance of the up to examined the eyes differs examined the eyes, Ophthalmology equipment characterized by having the detection optical system which detects the cornea reflected image of this illumination-light study system, and a decision means to judge the alignment condition of the cross direction to optometry-ed based on the detection result by this detection optical system.

[Claim 2] The ophthalmology equipment of claim 1 is ophthalmology equipment characterized by having a display means to display the alignment condition acquired by said decision means.

[Claim 3] The ophthalmology equipment of claim 1 is ophthalmology equipment characterized by having an output means to output an inspection start signal if it is judged by said decision means that an alignment condition is proper.

[Claim 4] The illumination-light study system of claim 1 is ophthalmology equipment characterized by having two or more sets of optical system which is in a symmetric position centering on the shaft of said inspection means.

[Claim 5] In ophthalmology equipment with required having an inspection means examined the eyes and aligning optometry-ed in a position relation to this inspection means An illumination-light study system with two or more sets of optical system which is in a symmetric position centering on the shaft of said inspection means, Ophthalmology equipment characterized by having the detection optical system which detects the cornea reflected image of this illumination-light study system, and a

decision means to judge the alignment condition over optometry-ed based on the detection result by this detection optical system.

[Translation done.]

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2. **** shows the word which can not be translated.
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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to ophthalmology equipment, and it relates to the alignment adjustment device which aligns optometry-ed and equipment in a position relation in more detail, observing optometry-ed.
[0002]
[Description of the Prior Art] Ophthalmology equipments, such as other ****** refractive-power measuring device and a cornea configuration measuring device, need to carry out alignment adjustment of the optometry-ed to the measuring beam study system of equipment at position relation.
[0003] The method of using the image examined the eyes and the cornea reflected image of the alignment light source which TV monitor for observation projected as an alignment adjustment device of ophthalmology equipment is learned. a ** person adjusts the direction of four directions so that a cornea reflected image may come to position relation to ally MENTOMA-KU which the image examined the eyes projected by superimposing on TV monitor, and a focus suits cornea reflected image -- as -- order (optical axis) -- a direction -- adjusting .
[0004] It is simple for structure or actuation, while adjustment of the direction of four directions can perform such an alignment approach comparatively easily, decision of the alignment condition of a cross direction is difficult for it, delicate adjustment carries out it, and

it has the problem of being hot.
[0005] Then, as an alignment device which makes easy alignment by the cross direction of a measuring beam study system, the alignment flux of light is irradiated from across to optometry-ed, and the device in which an alignment condition is judged is known by detecting the cornea reflected light in photoelectricity.
[0006]
[Problem(s) to be Solved by the Invention] In order to extract the alignment flux of light, the optical system of the dedication which is made to turn on by turns the source of the illumination light and the alignment light source which illuminate optometry-ed, or chooses each wavelength of the alignment flux of light and an illumination-light bundle, and detects the alignment flux of light is required for the above-mentioned alignment device.
[0007] However, turning on the source of the illumination light and the alignment light source by turns having the fault that a control circuit becomes complicated, and establishing the detection optical system of dedication had the fault that structure became complicated.
[0008] The technical technical problem of this invention is to offer the ophthalmology equipment which makes especially alignment of a cross direction easy, without having the alignment device of complicated structure in view of the fault of equipment conventionally [above-mentioned].
[0009]
[Means for Solving the Problem] In order to solve the above-mentioned technical problem, this invention is characterized by having the following configurations.
[0010] (1) In ophthalmology equipment with required having an inspection means examined the eyes and aligning optometry-ed in a position relation to this inspection means It is characterized by having the illumination-light study system which illuminates the anterior eye segment from which the optical distance of the up to examined the eyes differs examined the eyes, the detection optical system which detects the cornea reflected image of this illumination-light study system, and a decision means to judge the alignment condition of the cross direction to optometry-ed based on the detection result by this detection optical system.
[0011] (2) The ophthalmology equipment of (1) is ophthalmology equipment characterized by having a display means to display the alignment condition acquired by said decision means.
[0012] (3) If the ophthalmology equipment of (1) is judged that an alignment condition is proper by said decision means, it will be

characterized by having an output means to output an inspection start signal.

[0013] (4) The illumination-light study system of (1) is characterized by having two or more sets of optical system which is in a symmetric position centering on the shaft of said inspection means.

[0014] (5) In ophthalmology equipment with required having an inspection means examined the eyes and aligning optometry-ed in a position relation to this inspection means It is characterized by having an illumination-light study system with two or more sets of optical system which is in a symmetric position centering on the shaft of said inspection means, the detection optical system which detects the cornea reflected image of this illumination-light study system, and a decision means to judge the alignment condition over optometry-ed based on the detection result by this detection optical system.

[0015]

[Example] One example which applied this invention to the eye refractive-power measuring device is explained based on a drawing below.

[0016] [Optical-system] drawing 1 is the optical-system plot plan of the equipment of an example. The optical system of equipment is divided into a measuring beam study system, fixation target optical system, alignment index projection optics, and observation optical system, and is explained.

[0017] (Measuring beam study system) 1 is the two light sources for measurement which have wavelength in an infrared region, and is arranged rotatable centering on the optical axis. 2 is a condenser lens and the light source 1 is located in a before side focal location. 3 is a movable target plate for measurement so that it may have an index for measurement (spot opening) and may be arranged in eyegrounds examined [E] the eyes and a location [****]. 4 is a beam splitter made into the optical axis and the same axle of the first-digit label projection optics mentioned later. 5 is a projection lens and the projection lens 5 projects the index for measurement on eyegrounds examined the eyes.

[0018] 6 and 7 are beam splitters. 8, the band-like corneal-reflex removal mask with which it is arranged 9 in the relay lens and the location [**** / as the cornea examined / E / the eyes / 10], the migration lens which 11 moves with the target plate 3, and 12 are image formation lenses. 13 is a photo detector for measurement and a photo detector 13 is rotated centering on an optical axis synchronizing with the light source 1 for measurement, and the corneal-reflex removal mask 10.

[0019] (Fixation target optical system) 20 is a mirror, 21 is the 1st

movable relay lens about an optical-axis top, and the 1st relay lens 21 performs fog examined the eyes by moving in an optical-axis top. As for the fixation target with which 22 is arranged at the 2nd relay lens and 23 is arranged in the focal location of the 2nd relay lens 22, and 24, a condenser lens and 25 are lighting lamps.

[0020] (Alignment index projection optics) Alignment index projection optics consists of first-digit label projection optics which projects an index from a visual axis, and second-digit label projection optics which has the optical axis of a certain include angle to first-digit label projection optics.

[0021] First-digit label projection optics has the next configuration. 26 is the point light source which carries out outgoing radiation of the light of infrared light, and the point light source 26 is arranged through the beam splitter 4 in the before [the projection lens 5] side focal location. The flux of light which carried out outgoing radiation of the point light source 26 turns into the parallel flux of light with the projection lens 5, and makes a point light source image by the corneal reflex examined [E] the eyes.

[0022] 30 is second-digit label projection optics, and 4 sets (30a-30d) of projection optics is arranged at an angle of predetermined to the measuring beam shaft centering on the measuring beam shaft. Drawing 2 is drawing which looked at the second-digit label projection optics 30 from the subject side. The second-digit label projection optics 30 consists of projection optics 30a and 30c with the point light sources 31a and 31c which carry out outgoing radiation of the light of infrared light, and the point light sources 31b and 31d which carry out outgoing radiation of the light of infrared light and the projection optics 30b and 30d with collimating lenses 32b and 32d. As for projection optics 30a and 30c and projection optics 30b and 30d, a projection optical axis is arranged to a measuring beam shaft at the symmetry, respectively. Projection optics 30a and 30b is an include angle alpha, and projection optics 30b and 30c crosses at the include angle beta.

[0023] Projection optics 30a and 30c projects the index of limited ** on the optometry E-ed, and projection optics 30b and 30d projects the index of infinite distance on the optometry E-ed by the collimating lens 32. Since the cornea reflected image by projection optics is formed on the outskirts of a cornea examined the eyes, even if the reflected light does not turn to a measuring beam study system and it does not cope with cornea reflected light removal (a diaphragm is prepared in a location [**** / a light-receiving system]), the effect on system of measurement is avoided.

[0024] Moreover, second-digit label projection optics serves as an anterior eye segment illumination-light study system, and the light which carried out outgoing radiation of the light source 31 illuminates the optometry E-ed.

[0025] (Observation optical system and alignment index detection optical system) The flux of light from the anterior eye segment examined the eyes is televised by TV camera 43 through an objective lens 40, a mirror 41, and the tele cent rucksack diaphragm 42, after being reflected by the beam splitter 6. The anterior eye segment image examined [which was televised by TV camera 43 / E] the eyes and the cornea reflected image of the four light sources 31 and light sources 26 are projected on the TV monitor 44.

[0026] [Electric system] drawing 3 is the important section of the electric system block diagram of the equipment of an example. The video signal from TV camera 43 is digitized by A/D converter 51, and is incorporated by the frame memory 53 synchronizing with the signal of a timing generator 52 while projecting it on the TV monitor 44 through the image composition circuit 50.

[0027] Predetermined processing is performed in the image-processing circuit 54, the picture signal incorporated by the frame memory 53 is inputted into a microcomputer 55, and a microcomputer 55 obtains the coordinate location of an alignment index image with the signal.

[0028] The A/D converter with which 56 digitizes the signal from a photo detector 13, the driver to which 57 drives the light source 1 for measurement, the driver to which 58 drives the fixation target lighting lamp 25, the driver to which 59 drives the light source 26, and 60 are drivers which drive the light source 31.

[0029] 61 is a pulse motor rotating around the light source 1 for measurement, the corneal-reflex removal mask 10, and a photo detector 13, and 62 is the driver. 63 is a DC motor which moves the target plate 3 for measurement, and the migration lens 11, and 64 is the driver. 65 is a potentiometer which detects the migration location of the target plate 3 for measurement, and 66 is a detection processing circuit which performs predetermined processing to a signal from a potentiometer 65.

[0030] The actuation is explained in equipment with the above configurations. A ** person locates the optometry E-ed in a position, switches on an electric power switch, and makes each light source turn on. By lighting of the light source 26 and the light source 31, the cornea reflected image of the light sources 26 and 31 comes to project with the anterior eye segment image examined the eyes on the TV monitor 44. Drawing 4 shows the example of a display. 26' is the cornea

reflected image of the light source 26 of first-digit label projection optics, and 31a' - 31d' is a point light sources [of the second-digit label projection optics 30 / 31a-31d] cornea reflected image. 70 is ally MENTOMA-KU of the shape of a circular ring projected by non-illustrated reticle projection optics (ally MENTOMA-KU may be formed electrically and may be displayed).

[0031] Looking at the TV monitor 44, first, according to the sliding device of common knowledge, such as a joy stick, a ** person moves in the direction of four directions to optometry-ed, and does alignment of the optical system coarsely so that corneal-reflex luminescent-spot 26' may come to the core of ally MENTOMA-KU 70.

[0032] Then, the microcomputer 55 of equipment detects the coordinate location based on corneas from the location of corneal-reflex luminescent-spot 31a' of the image captured by the frame memory 53 - 31d'. The coordinate location based on corneas is called for as an intersection O of corneal-reflex luminescent-spot 31a' and 31c', and 31b' and 31d', as shown in drawing 5 . A microcomputer 55 calculates the amount of bias and the bias direction of the coordinate location O and an optical-axis center position based on corneas examined [which was detected] the eyes. These results of an operation are displayed through the image composition circuit 50 on the TV monitor 44. Although the result of an operation displayed on the TV monitor 44 may display the amount of bias, and the bias direction as data as it is, it is easy to recognize the direction to which the direction of graphical display, such as an arrow head, moves a ** person. A ** person moves equipment according to a display until the purport whose bias with a measuring beam shaft and optometry-ed is predetermined within the limits is displayed.

[0033] Next, alignment of the direction of an optical axis (cross direction) is performed. Each distance from the central point O to luminescent-spot 31a'-31d' is found using the coordinate of the central point O for which is the above, and it made and asked. Since luminescent-spot 31b' and 31d' are the images of the light source which is in the infinite distance optically, even if equipment shifts in the direction of a focus, the distance of Oand31b', and O.31d' hardly changes. On the other hand, since luminescent-spot 31a' and 31c' are the images of the light source which is in finite distance optically, the distance of Oand31a', and O and 31c' changes with gaps of the direction of a focus of equipment.

[0034] The condition of a focal gap is detected by comparing the distance of O and 31a', and O and 31b', using this relation. It is (b),

when the working distance of optometry-ed and equipment is set up so that it may be set to 0 and 31a'/0 and 31b'=A (A may give width of face by the relation between a constant and the alignment precision as which equipment requires the value of A). 31a'[0and]/0and31b'>A: Optometry-ed has shifted to the front.
(**) 0and31a'/0and31b'<A : optometry-ed has shifted back.
(**) 0and31a'/0and31b'=A : alignment is completed.
[0035] in addition -- comparing -- distance -- 0 - 31 -- a -- ' -- 0 - 31 -- b -- ' -- distance -- not only -- 0 - 31 -- c -- ' -- 0.31 -- d -- ' -- distance -- or -- 31 -- a -- ' - 31 -- c -- ' -- 31 -- b -- ' - 31 -- d -- ' -- distance -- ****** .
[0036] A microcomputer 55 displays this information on the TV monitor 44 through the image composition circuit 50. The method of presentation may show what shows the direct migration direction as shown in drawing 6 , and a predetermined directions mark. Moreover, in order that a ** person may look at and operate luminescent-spot 26', the direction shown near luminescent-spot 26' made optically does not need to move a look frequently, and alignment actuation becomes easy to act the display position of the alignment information on the direction of an optical axis as a ** person.
[0037] If alignment is completed as mentioned above, a ** person will push a measurement switch and will perform eye refractive-power measurement (if a microcomputer 55 judges alignment completion, a trigger signal is emitted and you may make it start measurement automatically).
[0038] The microcomputer 55 which received the trigger signal turns on the light source 1 for measurement through a driver 57. The measuring beam bundle which carried out outgoing radiation from the light source 1 for measurement reaches eyegrounds, after condensing near the cornea examined [E] the eyes through a condenser lens 2, the target plate 3, a beam splitter 4, the projection lens 5, and a beam splitter 6. In the case of a normal eye, it reflects by the beam splitter 7 and image formation of the target image reflected by eyegrounds is carried out on a photo detector 13 with the image formation lens 12 after passing relay lenses 8 and 9. When an ametropy is in optometry-ed, based on the input signal of the fundus-reflex light which received light by the photo detector 13, a microcomputer 55 drives DC motor 63, and it moves so that the target plate 3 may be come to eyegrounds examined [E] the eyes and a location [****] with the migration lens 11.
[0039] Next, after it moves the 1st relay lens 21 and eyegrounds examined [a fixation target 23 and / E] the eyes set in a location

[****], this is further moved so that fog may start by suitable diopter. After fog has started the optometry E-ed, the light source 1 for measurement, the corneal-reflex removal mask 10, and a photo detector 13 are rotated 180 degrees around an optical axis. The target plate 3 and the migration lens 11 can move with the signal from a photo detector 13 during rotation, POTENSHUME-TA 65 can detect the movement magnitude, and the refractive-power value of each circles-of-longitude direction can be known. When a microcomputer 55 performs predetermined processing to the refractive-power value of each circles-of-longitude direction, the refractive power examined the eyes is acquired and a measurement result is displayed on the TV monitor 44 through the image composition circuit 50.

[0040] Moreover, the printout of the measurement result is carried out from a printer by pushing a print switch.

[0041] In this example, since luminescent-spot 31a' on the TV monitor 44 - 31d' are not used as alignment information which a ** person performs visually, they can set as arbitration the include angles alpha and beta by which a slanting alignment index projection optics [30a-30d] projection optical axis is arranged according to the detection precision of the luminescent-spot detection by image pick-up optical system, and the demand of equipment. That is, by enlarging an include angle alpha, distance from the core 0 of luminescent-spot 31a' - 31d' can be enlarged, and since bias of the amount of gaps of the direction of a focus becomes large, the precision of focal detection can be raised. On the contrary, since an include angle beta is made small, enlargement when including the slanting alignment index projection optics 30 in equipment is avoided. Moreover, the tele cent rucksack diaphragm 42 can also be made into a slot configuration, and it is not necessary to also increase especially sharply the quantity of light of the light source 31 which serves as anterior eye segment lighting.

[0042] As mentioned above, although the example which applied this invention to the eye refractive-power measuring device was explained, this invention is not restricted to this and various changes are possible for it in various ophthalmology equipments. For example, as mentioned above, although it has in the example the first-digit label projection optics used for the alignment of the direction of four directions, since the coordinate location based on corneas can be obtained from the location of corneal-reflex luminescent-spot 31a' by the second-digit label projection optics 30 - 31d', the index used for the alignment of the direction of four directions can be electrically formed on the TV monitor 44, and first-digit label projection optics can

be omitted.
[0043] Moreover, although the ** person itself does alignment actuation based on the detection result of an alignment condition in the example, drives, such as a motor which moves optical system in three dimension, can be formed further, and alignment can also be automatically carried out by control of the microcomputer which detected the alignment condition.
[0044]
[Effect of the Invention] Without changing conventional ophthalmology equipment sharply according to this invention, as explained above, an easy alignment detection device can be realized and alignment of a cross direction (the direction of a focus) can be performed especially correctly and easily.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the optical-system plot plan of the equipment of an example.
[Drawing 2] It is drawing which looked at second-digit label projection optics from the subject side.
[Drawing 3] It is drawing showing the important section of the electric system block diagram of the equipment of an example.
[Drawing 4] It is drawing showing the example of a display of the anterior eye segment image examined the eyes and the cornea reflected image of the light source projected on TV monitor.
[Drawing 5] It is drawing explaining the coordinate location detection based on corneas.
[Drawing 6] It is drawing showing the method of presentation of the

alignment information on the direction of an optical axis.
[Description of Notations]
30 Second-Digit Label Projection Optics
43 TV Camera
44 TV Monitor
53 Frame Memory
54 Image-Processing Circuit
55 Microcomputer

[Translation done.]

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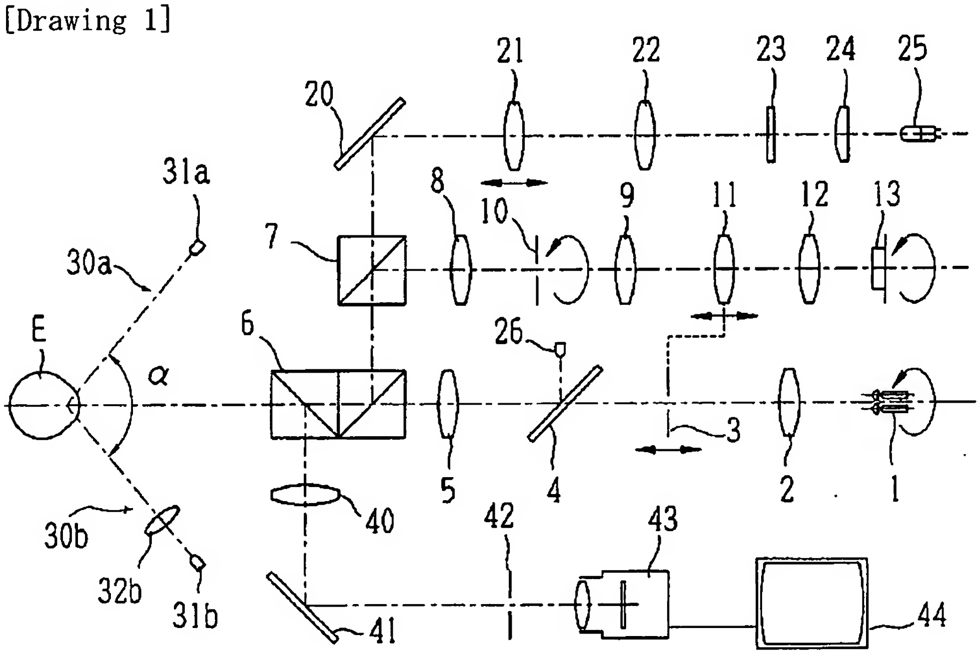
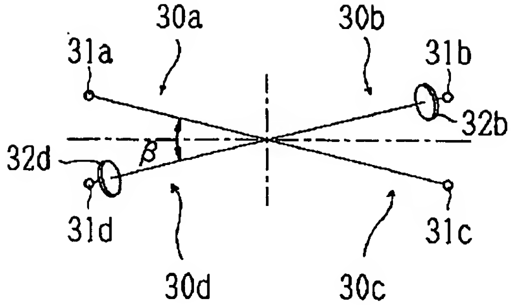
DRAWINGS

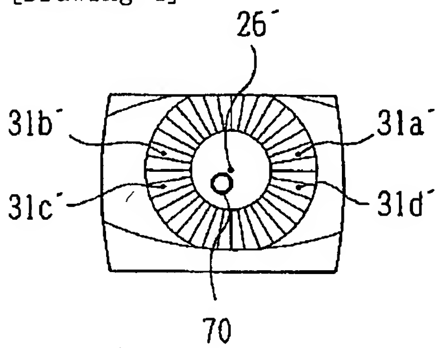
[Drawing 1]



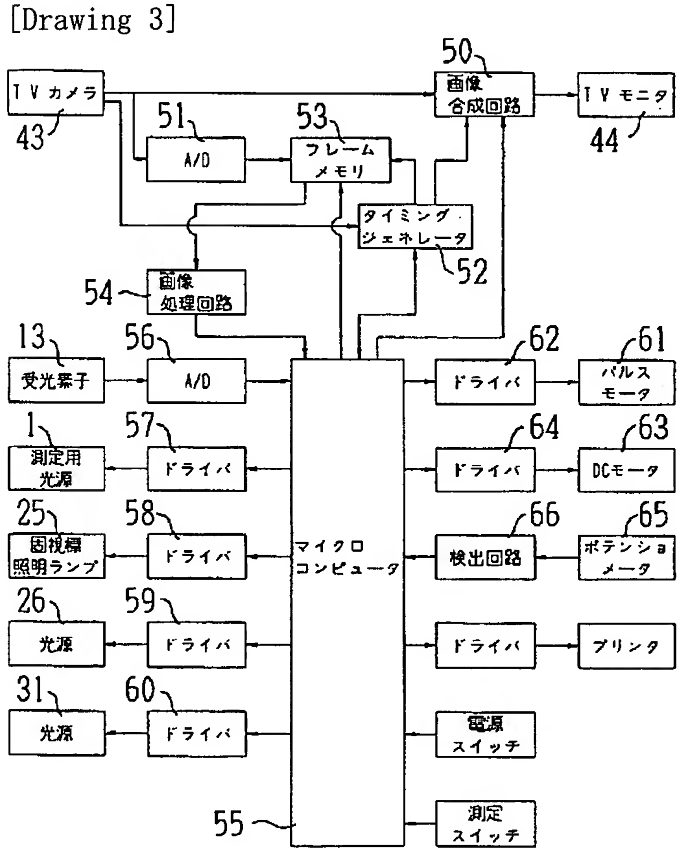
[Drawing 2]



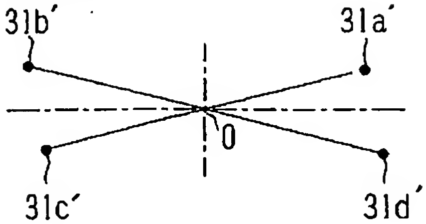
[Drawing 4]



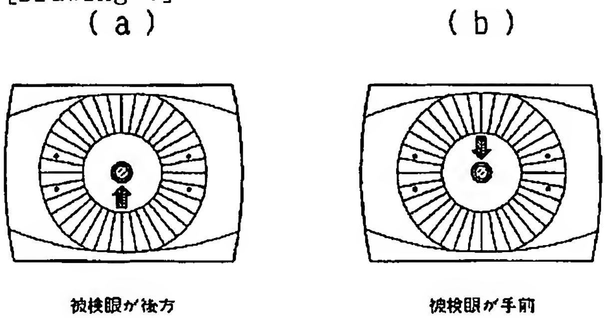
[Drawing 3]



[Drawing 5]



[Drawing 6]



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